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ABSTRACT

In reviewing recent literature on the effects of class size on instruction and the implications for English and language arts instruction, this compilation gives teachers and educators a thorough list of references. The first 10 pages of the review are devoted to a description of various earlier literature and research reviews on class size and its relation to teacher attitudes, teaching methods, academic achievement, and teacher behavior, among other concerns. The second section reports on studies of class size effect on achievement, and examines several significant debates in defining class size and determining achievement levels. The third section covers studies on class size and its effect on quality, including better teacher-student relationships, individualized instruction, and fewer discipline problems, while the final section details some particularly comprehensive studies, most of which were remarkable because of combinations of thoroughness, control, and content. (CRH)

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A Review of Recent Literature On the Effects of Class Size, with Implications for English and Language Arts Instruction

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Reviews of Reviews

One thing is certain: teachers prefer small classes. There is no research, poll, or word of mouth query that will contradict this statement. They believe that smaller is better in terms of how creative and energetic--tuhs, how effective--they can be as teachers; they also believe that smaller classes make for a more desirable classroom environment; and consequently teachers believe that the small-sized class causes a higher level of student achievement than large classes (Cotton and Savard, 1980; Millard, 1977; Shapson, 1978; Haddad, 1978; and many others). Over the last ten years there have been many studies and reviews of literature concerned with this faith which classroom teachers have in small classes. A review of the research and reports published since 1970 on the effects of class size shows that, as is usually the case with generalized faith, the matter is more complicated and multiplistic than it seems, therefore providing no absolute yes or no to the question: are small or large classes better? Such a question reduces "better" to the variable of class size alone, and research or observation will quickly prove that many factors combine with class size to determine the quality of educational experience (Cotton and Savard, 1980; Chang and Ogletree, 1979; McClusky, 1978). And even when considering class size in isolation, one finds that there are benefits and problems with both large and small classes (Haddad, 1978). Because most studies either fail to consider every possible factor or operate under manipulative biases, the majority of work by researchers reveals either no significant results or results which seem significant, yet which are not trustworthy.

Nello Vignocchi (1980) reports that a lack of experimental control and a lack of thorough consideration of the whole class environment have

created a series of insignificant findings in class size research. Vignocchi (1980) does cite some significantly positive effects of small class size on reading achievement and math concepts learning. But the number of reported studies favoring large classes for achievement in these same subject areas casts doubt on even these significant results. Vignocchi concludes his report by observing that class size is negligible unless coupled with good instruction (1980). He suggests that the way in which a teacher uses the time for student/teacher interaction which smaller classes allows is the factor which truly determines the student's achievement (Vignocchi, 1980).

A review of research by Cotton and Savard (1980) reiterates the importance of teaching method to the success or failure of a class of any size. Even though smaller classes have the potential for the teacher's developing and using a wider variety of instructional skills, this development and use does not occur automatically with the reduction of class size (Cotton and Savard, 1980). These researchers argue that there is no optimum class size for all instructional situations, and that appropriate class size depends on age/grade, student aptitude, subject, and instructional method. Along with these variables, researchers must more clearly define their terms--"large," "small," "class"--in order for results discussed in these terms to have any applicable meaning (Cotton and Savard, 1980). Thompson (1978) asks what context class size is considered and defined within: teaching goals, school system and structure, students' character. All points considered, Cotton and Savard (1980) have found a significant advantage of small classes regarding low ability, special education and primary students,

and regarding student attitude, teacher morale, and the flow of classroom processes.

Soo Chang and Earl Ogletree (1979) cite reports demonstrating that the relationship between class size and academic achievement depends on the way the teacher manages and organizes the class. Again, Chang and Ogletree find age/grade levels, ability/aptitude, and socio-economic status to be factors in class size effect, smaller classes proving beneficial for younger pupils, pupils of lower ability, and pupils of low socio-economic conditions. Chang and Ogletree (1979) agree with other scholars that small classes only offer the possibility for, but do not insure, a teacher's improved instructional method. They add that if a teacher has certain instructional weaknesses, these too will be exagerrated by reducing class size (Chang and Ogletree, 1979).

Lawrence McClusky believes that we should consider what ends we want to serve by manipulating or analyzing class size, since there seem to be several clear reactions to the class size question but no certain understanding of how to apply constructively those reactions (McClusky, 1978). Wadi Haddad (1978) points out the pros and cons of different sizes. He explains that, according to research, a small class will allow for instructional variety, greater interaction and relations among students, more individual learning, more creative activity, more divergent thinking and fewer discipline problems. Smaller classes, he says, will also create an increase in the number of emotional and intellectual demands on students and on teachers, causing an increase of personal exposure, a greater need to be alert, feelings of being under closer scrutiny of peers and superiors. Plus, Haddad (1978) mentions that

in a smaller class, though there is usually more time and room for a teacher to be attentive to individual needs, this attention may deny the student the time for independent learning. Schofield (1974) notes that smaller classes provide cohesiveness, closeness, but adds that they are more difficult and that they increase the effects of peer pressure. Schofield also reports that larger classes are good for their variety and for the interpersonal relationships they foster, yet also that they contribute to a higher level of interpersonal aggression and disruption (Schofield, 1974). Such a diversity of class size results supports McClusky's recommendation of carefully considering our goals for studying the issue. If the goal is better achievement, then according to research there is no guarantee that class size is what we should be trying to use as a means. It is plain to McClusky that class size alone does not control achievement criterion scores (1978).

Although research continues to support the notion that smaller classes create a better overall classroom quality, McClusky (1978) reminds us that classroom quality does not necessarily have any effect on achievement or learning. Many researchers, however, believe classroom quality to be an important factor of achievement, and therefore an important goal for educational planning and research. Ian Templeton (1972) cites Martin Olson's study (1971) using the "Indicators of Quality" test scores as empirical evidence that smaller classes produce higher levels of quality in the classroom environment. Olson's study, examining classes for individualization, interpersonal regard, group activity, and creativity will be discussed at length later in this report. His influential findings, however, are cited in various reviews of literature for their implications of the effect of class size on specific classroom quality conditions. Templeton (1972) points out that most of the

studies supporting small classes are concerned with factors other than raw achievement, a fact that reminds one of McClusky's questioning the researcher's and the educator's goals and concerns. If McClusky is correct in his implication that there is no connection between classroom environment and achievement, then one must decide how important teacher and student morale, among other factors, are in and of themselves in the operation of schools. If there is a connection between quality and achievement, researchers must find and define that connection more clearly than they have in the past.

One way of improving on research in this regard is the performing of longitudinal studies rather than those which last for only a semester or a year. In his review of literature, Lindbloom (1970) asserts the significance of classroom quality (via small classes) on academic achievement. Lindbloom (1970) cites findings which indicate some of the benefits of small classes: small group activity, mass orientation as well as individual concern, individual attention at the primary level, greater chance for arranging individualized instruction, and a greater variety of educational activities per normally scheduled class time. The achievement benefits of small classes may be recognized, he says, in studies which allow enough time for teachers and students to adjust to class size changes (Lindbloom, 1970). The problem with small classes, he argues, is teacher's failures to adjust to their potential advantages. In one study which Lindbloom analyzed, forty-three percent of the instruction taking place in the small class was designed for large classes: mass oriented, lecture format (1970). McKeachie (1971) contends

that many teachers have been trained by the impositions placed on them in the past by large classes, and are unable to change their approach when faced with the instructional options which smaller classes provide. A report by David Pidgeon (1974) notes the need to break from the traditional large class approaches which are naturally restricting and limiting, especially for smaller groups. The implication is that teachers should break from the strictly large class approach, even in large classes. Lindbloom cites the longitudinal studies of Balow (1969) and of Furno and Collins (1967), covering four and five years respectively as proof for the success of time in overcoming the patterns of previous instructional methods. Both of these studies favor small classes for student achievement, the latter favoring small classes for overall achievement, reading achievement, and math achievement by a ratio of 7.3 to one for classes of 25 or fewer students compared with classes of more than 25 (Lindbloom, 1970).

One argument against manipulating class size is its independence from directly influencing improved teacher behavior. Lindbloom argues that, given word of the class size change and time (approximately three years, he says) to adjust methodology, the teacher can react in a way that class size change can directly and independently affect teacher behavior and, in turn, student achievement (Lindbloom, 1970). He recommends more longitudinal studies to bear out his contention.

Pidgeon (1974) supports the idea that attitude affects achievement. He cites certain achievement problems with small and large classes which are caused by the social or attitudinal conditions in these different sizes. Calling on the research of Burstall (1970), Pidgeon (1974) reports that performance in French classes (ranging in size from three to forty-nine)

decreases if the size dips below twenty because of a lack of vitality in the smaller class. Also, he reports that generally larger classes contribute to students' failure by their being exhausting and frustrating (Pidgeon, 1974). Pidgeon (1974) also cites different factors other than, or along with, class size which can contribute to academic achievement: homogeneity of classes, grade/age level, work space provided, subject studied, social status, amount of ancillary assistance used in teaching, and overall teacher load. He stresses the often unconsidered importance of teacher workload as a factor contributing to class quality and student achievement in relation to class size. Sydney Thompson (1978) agrees that teacher load is important to student achievement and often ignored by researchers.

William Murphy (1975) rejects the contention that the teacher load (pupils taught per day) has any effect on pupil achievement. But Betty Bamburg (1977) reports in detail the hazardous effect that a load of more than 150 students a day per teacher can have on such activities as the teaching of composition (in special composition classes and in other general English classes), and in specialty classes even where the individual class size is small, such classes demanding that a teacher prepare separately for three or more different classes every day.

While Murphy reports a study performed in 1930 which states that better themes are written in larger (50) English classes than smaller (20) ones, Arthur Applebee (1977 and 1978) describes the damages that large classes and heavy loads wreak on the quality of English instruction. With a daily

load of 150 students (typical, but far-exceeding the recommended load), a teacher of English will spend around 20-25 hours a week on grading papers alone, not to mention the time that this same teacher will spend preparing for class and serving on extra-curricular committees and programs (Applebee, 1977). Applebee (1978) reports that the award winning students in the 1977 NCTE Achievement Awards in Writing were all from smaller classes in which discussion of papers, conferencing, writing process orientation, and imaginative/expressive writing could occur. Teacher overloads cut into the time needed to apply this much care in the teaching of composition.

Murphy (1975) blames inconclusiveness on the absence of good research: lack of randomness, lack of control over teacher variables, lack of control over socio-economic situations in different school districts, and lack of longitudinal studies. He cites Balow (1969) and Furno and Collins (1964) as designing good longitudinal studies, but he doubts their results because, he says, they failed to consider other important effective factors. For example, most of the classes in these longitudinal studies which showed significant benefits from small size contained students of low ability, says Murphy (1975). Murphy adds that in most studies, including these extended ones, there is no significant difference in achievement due to different class sizes, and that, in fact, some which do show differences differ in favor of larger classes (Murphy, 1975).

Christopher Jencks (1974) comments that smaller classes may very well widen the gap between disadvantaged and advantaged pupils: "Making learning highly competitive and therefore defining some children as 'successes' while others are 'failures,' schools make it more difficult for the slower children to learn anything and more attractive for the quickest to learn a lot" (Jencks,

1972, p. 87). Here, Jencks is reiterating the fear expressed by Haddad (1978) that the smaller class applies oftentimes harmful amounts of pressure onto its students. Jenck's concerns reflect his desire to move beyond "conventional wisdom" into the actual dynamics of operation and causality of class size/achievement relationships (Jencks, 1972). To the assumption that experienced teachers are effective teachers, Jencks argues the possibility that experienced teachers are simply those with more "bargaining power" who can transfer into schools with overachieving students. Likewise, to the assumption that schools with small classes have students with unusually high verbal scores, Jencks (1972) argues that these smaller classes often occur in school districts which generally have small classes, thus perhaps more money to create those smaller classes, more money to hire the best teachers, or more affluent, education-conscious parents. With such districts involved in a study, district demographics become important factors in choosing two schools for a comparison. Jencks notices that when comparing classes from similar schools in the same district there is almost never a difference in achievement between students from large classes and students from small classes. This observation implies that, when achievement differences do occur, they are caused by factors other than class size (Jencks, 1972). Jencks completes his case against traditional wisdom by questioning the normal assumptions of causality, arguing that in many cases high achievement, the formation of small groups of students with special advanced needs could cause the formation of small classes for advanced students, creating the appearance that the small class size produced the advanced achievement (Jencks, 1972). This same assumption can work in reverse, as specialized low ability students create

their own small class, possibly giving the impression that the class size caused the students to perform below average (Jencks, 1972).

A group of graduate students from the University of North Carolina at Chapel Hill have reviewed class size literature and conclude that only under "unusual circumstances" is there a direct relationship between small class size and positive academic achievement (1978). In general, these researchers report that "it appears to be quite clear that if neither method nor content are changed, then reducing class size will have no significant effect upon student attainment" (UNC-Chapel Hill, 1978).

Stanley Laughlin (1976) determines from his review of studies that the benefits of smaller or larger classes are social or psychological, but not academic. Teachers think that smaller classes promote better student/teacher relationships, and, according to Laughlin, many of the class size changes and manipulations are made for "purely social" reasons rather than for reasons based on research (Laughlin, 1976).

If one is considering changes in requirements and policies to effect class size in schools, it is important that the people orchestrating the change understand the real causalities and reactions of such change. One should know and support the reasons for changing class size (Millard, 1977). If the goal is better classroom quality, then Olson's findings have been reported as "some definitive answers" favoring small classes (NEA, 1977). Yet, critics of Olson argue that his measures of quality use predetermined concepts of quality which change from study to study (Thompson, 1978). A closer look at specific studies, even if it offers no answers, may clarify some questions.

Class Size Effect on Achievement: A Report of Studies

As has been mentioned, the effects of class size on pupil achievement are highly inconclusive, with almost as many different results as there are studies. Lynne Johnson and Roan A. Garcia-Quintana (1978) tested the effects of class size and the use of teacher inservice training on the achievement of South Carolina first graders. The South Carolina First Grade Pilot Project was carried out twice, once during the '75-'76 school year, and again during the '76-'77 school year. In '75-'76, the researchers offered inservice training to some of the teachers involved with the study and not to other teachers in the study. Also, paraprofessional assistants were used in the first year which were not used in the second (Johnson and Garcia-Quintana, 1978a). Pre- and Post tests for achievement (Comprehensive Tests of Basic Skills, levels A and B) were given to the students, first graders from across South Carolina, broken into classes of approximately 19 and approximately 27 students (Johnson and Garcia-Quintana, 1978a). In the first year, teachers who had received inservice training produced increases in reading achievement regardless of class size compared with the ordinary classes in those schools. The only group not showing significant increase in achievement was the large class for which the teacher received, during the course of the study, no inservice training (Johnson and Garcia-Quintana, 1978a). Overall achievement and reading achievement were better in the smaller classes than in the larger classes. There was no significant difference between the achievement of students in smaller classes and students in larger classes for math or language (Johnson and Garcia-Quintana, 1978a).

Vana Meredith (1977) describes this same '75-'76 First Grade Pilot Project. Null hypotheses were formed originally, he says, based on the inconclusiveness of the review of previous studies. The researchers expected class size and teacher inservice training to have no significant effect on student achievement in math or reading. However, the results of the first year's project, as reported by Meredith (1977) are as follows: mean post test scores in reading achievement were significantly higher for smaller classes; mean post test scores for reading achievement were not significantly higher for classes with teachers who received inservice training; small classes which had teachers who had not received inservice training showed the highest mean scores for reading achievement; and large classes without inservice teacher training showed significantly lower reading achievement scores than any other type of class (Meredith, 1977). For math achievement Meredith (1977) reports no significant difference in achievement due to class size, teacher inservice training, or any interelation between the two factors. Language achievement was not affected by class size, inservice training, or their interelationship; and of all three variables, only class size had an effect on "overall" achievement post test score averages (Meredith, 1977).

Johnson and Garcia-Quintana (1978 b.) report on the '76-'77 South Carolina First Grade Pilot Project. The null hypotheses, again, were proposed. But the variables involving teacher inservice training were eliminated as all teachers received equal of such training--three inservice sessions between pretest and posttest (Johnson and Quintana, 1978 b.). The researchers in '76-'77 expected no significant difference in reading achievement, math

achievement, language achievement, or overall achievement depending on the variable of class size. The small classes (experimental group) contained approximately twenty students and the large (control group) approximately twenty-nine. The fifty classes participating were balanced for extraneous variables of race and sex and students who had attended kindergarten. The small classes had a slightly higher percentage of Title I students than did the large classes, a factor, which, among others, the researchers credit for the somewhat different results in the '76-'77 test compared with the '75-'76 test (Johnson and Garcia-Quintana, 1978 b.). The results of the second year's test follow: no significant difference in reading achievement between large and small classes; no significant difference in math achievement between large and small classes; no significant difference in language achievement between large and small classes; no significant difference in overall (post-test combination) achievement between large and small classes (Johnson and Garcia-Quintana, 1978 b.). As well as the small classes' extra Title I students possibly balancing out any advantages those classes may have enjoyed due to size, the absence of experimentally uncontrolled paraprofessional help and the universal nature of teacher inservice training may have removed formerly effective factors, say Johnson and Garcia-Quintana (1978, b.). Some may infer that training all of the teachers raised what was, in the first study, lower achievement, thus balancing to "no significant difference" by improving all classes. However, if, according to Meredith (1977), the best results occurred in small classes with teachers who had not received inservice training, the blanket application of inservice that occurs in the second study may have lowered the performance of small classes while it raised that of some larger classes. Selective inservice training, based on

the particular needs, intelligently assessed, that different class sizes create, may produce the best achievement results overall. For better future study, Johnson and Garcia-Quintana (1978 b.) recommend extending the South Carolina study to a longitudinal format, including three or more class sizes, and considering the effects on achievement of race, sex, socio-economic status, and academic ability, in relation with class size.

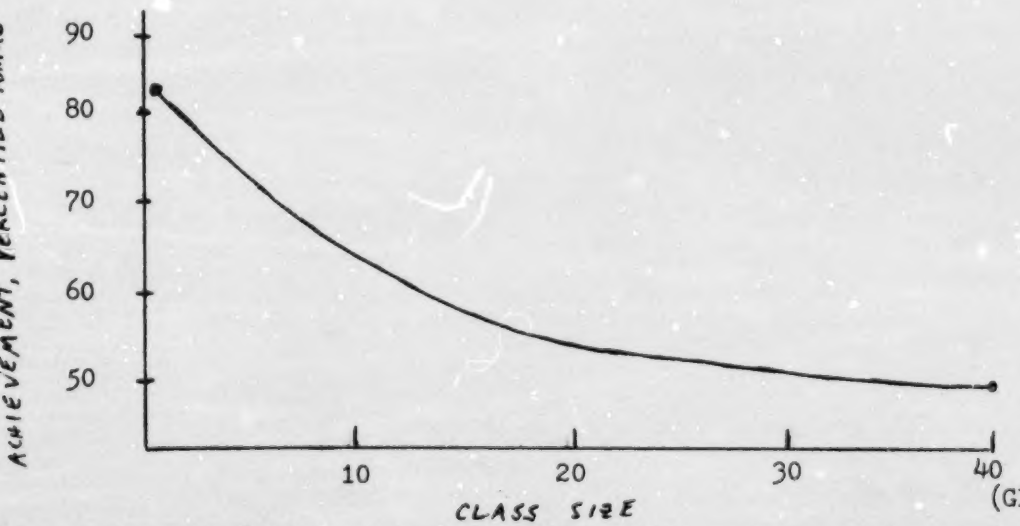
Results of class size studies can vary significantly, as the South Carolina First Grade Pilot Project shows, when they are repeated with slight alteration, or even when the same study is described by two different sets of researchers. This phenomenon demonstrates the intricasies which contribute to various reports, and it shows the impact of perspective and communication on the results of studies. With these tentative characteristics in mind, consider the next study of class size effect on student achievement, the Meta-Analysis of Gene Glass and Mary Smith (1978). Its results ostensibly reflect all class size/achievement reports compiled over the course of the twentieth century. Glass and Smith began their study by reviewing the literature on class size since 1900, using the key words, "size," "class size," and "tutoring," to search ERIC and Dissertation Abstracts, and using the bibliographies of the studies found. Of approximately 300 articles found and read, 76 were deemed valid and relevant and were used in the meta-analysis (Glass and Smith, 1978).

Once gathered, the information was applied to a statistical formula designed to determine the difference in achievement between any two classes of different sizes. This formula would find a value, Δ_{S-L}, by subtracting the average achievement of the larger class, $\bar{X}_L$, from the average achievement of the smaller class, $\bar{X}_S$, and dividing by the estimated within-class standard deviation, "assumed to be homogenous across the two classes" (Glass and

Smith, 1978):

$$\Delta_{S-L} = \frac{\bar{X}_S - \bar{X}_L}{\delta}$$

To rationalize including studies of various quality and validity, Glass and Smith noted that the better quality studies showed results of the same type as poorly done studies, except that those good quality results were more clear, extreme, and significant in expression. The mixture of quality, therefore, they believed, did not negatively affect the results they obtained. These results, simply stated, are that classes of less than or equal to twenty pupils achieve significantly more than classes of greater than twenty pupils (Glass and Smith, 1978). Glass and Smith modified this simple generalization by designing a graph which compares class size (0-35) with percentile rank of an average pupil (100-50):



(Glass and Smith, 1978)

This graph enabled them to express differences in achievement due to class size which would, normally expressed, be too small to be significant. For example, there is hardly any noticeable difference in achievement for an average student between class sizes of 35 and 20. But when expressed in changing percentile points, the difference becomes one of moving from average

(fiftieth percentile) to well above average (over the sixtieth percentile rank). Such a change in class size, according to the implications of Smith and Glass (1978), could improve each class' overall average achievement significantly.

Glass and Smith's study has been well-received and used for a point of departure into new research by Cahen and Filby (1979). These researchers accept Smith and Glass' results and form a list of new lines of enquiry that would help explain the reasons for the class size effect reported by the meta-analysis. Cahen and Filby are likely to accept Glass and Smith's results enthusiastically, however, since they co-authored with Glass and Smith the first report of the meta-analysis for the April-May, 1979 issue of Phi Delta Kappan. Except for a few teachers and principals who were eager to find evidence to strongly favor smaller classes, the Glass, Smith, Cahen and Filby study has been accepted with skepticism. Its chief and earliest critic was the Educational Research Service of Arlington, VA. The ERS begins their criticism by reminding the public that a substantial proportion of the comparisons used in constructing the meta-analysis' graph below twenty pupils dealt with "extremely small intructional arrangements such as one-to-one tutorials and classes of two to five pupils" (ERS, 1980). Their implication is on one hand that the category is not necessarily less than twenty, as in eighteen, but less than twenty, perhaps as in five, or two, and therefore that the report is misleading. On the other hand, their implication is that, accepting success in a class of 2-5 pupils, reducing all classes to this effective size would be economically and practically impossible. The ERS

goes on to argue that Glass and Smith have ignored the insignificance of class size as is indicated by the right side of the graph and rest their entire argument for smaller classes on the left side (classes below 20 in size); thus Smith and Glass unjustifiably overgeneralize their results (ERS, 1980). Smith and Glass rely on too few studies, say the ERS (1980): "of the 110 comparisons used in producing the graph, 73% came from only four of the 14 studies [which the authors considered "well controlled"]" (ERS, 1980). The ERS believe that in mixing and comparing well and poorly done studies, Smith and Glass reduce even the meaningful studies to the validity level of the least valid study analyzed (ERS, 1980).

Gene Glass answers selected criticisms from the ERS, explaining a balanced proportion of all class sizes, including but not biased toward, extremely small classes. He explainsthe significance in percentile rank even in the farthest right ranges of the graph. And he explains, as I have already mentioned, the harmlessness, indeed the supporting qualities, of poorly executed studies in comparison with strong studies (Glass, 1980).

There were more complaints from the ERS against the work of Glass and colleagues, many of which Glass answered in rebuttal, and all of which would make this report more lengthy than it is already destined to be. Suffice it to say that the ERS responded to Glass' rebuttal, implying that Glass' defensiveness and sarcasm added to the reasons for doubting the objectivity and accuracy of the meta-analysis report. Glass, in turn, found that the ERS's critical conclusions "confused, garbled, and empty--counsel only inaction"(Glass, 1980).

Others have commented on Glass, Smith, Filby, and Cahen's results, some skeptically, but not quite as aggressively as the ERS. Frances Cacha (1982) acknowledges and accepts the ERS's criticism of the meta-

analysis performed by Glass and his colleagues, doubting the statistical significance of the meta-analysis' results, questioning the success of integrating the results of many different studies, and reiterating the warnings against generalizing, both in terms of results and in terms of the language they use to describe these results. "Can their most quoted conclusion, 'average pupil achievement increases as class size decreases,' be used without qualifications . . . ?" (Cacha, 1982).

Fritz Hess (1979) points out some of the flaws in Glass' and colleagues' methodology. First, they assume that the large size of the analysis sample assured them of randomization; where in reality, according to Hess (1979), the boundaries of the sample were "fixed by a variety of experiments and researchers, each concerned with the issue of class size." The approaches to, and reports of, the South Carolina project illustrate this factor of variety. Second, Hess reports the uncertain influence of the time variable between 1900 and 1979, recognizing that results may change with the changing motives and expectations of researchers, which of course change from era to era, through history. Third, Hess states that the large sample might compound the errors of past studies. Fourth, Hess warns against Glass and Smith's lack of respect for "statistical significance." He states that the researchers force multidimensional results onto a linear scale, limiting their scope of classroom demographics to only two factors: pupil ability and pupil age, while ignoring factors such as the teacher's salary, students' socio-economic background, overall morale and attitude and other environmental conditions under which methodologies and performance must function and occur (Hess, 1979).

By using statistical modifications of Glass' study, however, Hedges and Stock (1983) repeat the meta-analysis of class size effect on student achievement, obtaining similar results and, through their modifications, eliminating some of the troublesome factors of Glass' randomness, "linearity," and diverse class sizes. Hedges and Stock produce a four dimensional graph which describes more thoroughly the dynamics involved with class size differences and achievement. Applying this new formula of analysis requires the disgarding of cases which are biassed or which have insufficient information. Hedges' and Stock's modifications of Glass' statistic "is sensitive to the amount of information upon which the individual effect size estimates are based, that is, large or small degrees of freedom, [Glass'] procedure is not" (Hedges and Stock, 1983).

Glass, himself, in a calmer tone than he uses with the ERS, tries to explain some of the problems that consistently arise in regard to his technique of meta-analysis (Glass, 1982b). He describes as the benefits of meta-analysis, his contentions that it is quantitative, does not prejudge findings in terms of research quality, and seeks general conclusions (Glass, 1982b). Glass argues that the assumption is false that one must compare similar studies lest one become guilty of matching apples and oranges. Researchers are safe and correct to compare differences. Just because research is less than perfect, Glass insists, the results of a study should still be considered and can contribute to significant findings. Other critics have accused Glass' results of being biassed by the medium--journal, book, thesis, dissertation--in which the different data were found. To this, Glass emphasizes that a meta-analyst must collect all available literature and then adjust for the different publication (and other) biases. Glass

admits that meta-analyses are carried out on lumpy sets of non-independent data, and he expresses the need for averaging the results of similar conditions for the purposes of condensing variables (Glass, 1982b).

Several other studies of the effects of class size on academic achievement either support the null hypothesis, as does the South Carolina project, of they find only limited effects of class size on achievement. Marshall Woodson (1968), for example, finds small classes to produce higher achievement for low ability students and reading classes; but he also found that most math classes produced better achievement if they were large, rather than small. He also found that class size was a less important factor of achievement in higher grades than in younger, lower grades (Woodson, 1968).

The District of Columbia Public Schools (1978), using scores on the Prescriptive Mathematics Test as data, found no significant or consistent effect of class size on average percentage of posttest objectives mastered in mathematics.

Joseph De Angelis (1977) found no significant effect of class size on achievement in secondary school science laboratory, but his study lasted only for six months, with De Angelis himself teaching both sections (sizes 46 and 23) of the study, using the same method for both. The brevity of the study and the fact that De Angelis' teaching did not account for the changing environment are reasons to question the validity of this finding of "no significant effect." But his study is an illustration of the importance of both longitudinal and methodological adjustment in order to properly take advantage and notice advantages that other studies attribute to small or large classes.

Jim Lindsey (1974) determined that the three most important variables in the interelationship of class size, hours of instruction, and achievement are: a) the student's family's social class, b) the student's program of study, and c) the student's sex. Though achievement in academic programs was unaffected by class size, Lindsey found that the achievement in vocational and general programs in seven different countries increased as class size increased, to peak achievement levels at optimum class size and hours of instruction. These levels varied, depending on the student's sex (Lindsey, 1974). In some cases, girls in Scotland for example, there was no ceiling of optimal class size--the larger the class, the better the performance--while in others, say, Scot boys, there was an optimal class size of approximately 29, around which either larger or smaller classes produced poorer achievement (Lindsey, 1974). Since his findings are observational rather than experimental, Lindsey warns that factors other than size, factors that he had not controlled for, could be causing the achievement differences.

In a later article co-authored with Cherkaoui, Lindsey (1975) adds that the students of lower social class seem to benefit from large classes more than from small classes, at least in terms of achievement. He proposes as a reason for this phenomenon the possibility that in generalizing to the larger group, the teacher is less likely to speak in an elitist fashion unfamiliar to the student with an oftentimes unsophisticated, or un-"standard" language base. Therefore the communication from teacher to socially deprived student will be clearer as the teacher considers that her audience is larger, likely to be more diverse, and therefore demanding a more careful communication (Lindsey and Cherkaoui, 1975).

In the teaching of composition, Susan P. McDonald (1980) reports that a class size of no more than 15 improves student achievement in writing by increasing the amount of feedback the student can receive and the amount of re-writing/revising that can occur under supervision.

Since 1970 or thereabouts, there have been some significant studies of the effect of class size on student achievement. But because of the multitude of variables at work around this issue, the results of studies have been either questionable and unreliable or inconclusive and virtually useless. Such is not the case with studies of class size effect on conditions of teacher morale, student attitude, and overall classroom quality.

Class Size Effects on Quality: A Report of Studies

One of the reasons for improved academic quality in decreased class size is that teachers do, or at least are free to do, things differently in smaller classes, as opposed to the reported limitations of larger classes (Noli, 1980). For example, in smaller classes, teachers are better able to diagnose student problems and needs. Also, since the teachers are likely to know each student more closely and personally in a small class, they will be able to more effectively fit a cure to the diagnosed problems than in a larger and more impersonal class (Noli, 1980). For the same reasons of intimacy, the teacher of the smaller class can offer more substantive and helpful feedback than the teacher of a larger class (Noli, 1980; and McDonald, 1980). The fewer discipline problems of smaller classes, compared with larger classes, allows for more instruction time per class period (Noli, 1980). If one can assume that learning and educational quality are directly proportional to the time engaged with learning activities, then the smaller class, providing more "on-task" time for students and instruction/monitoring attention from teachers, would seem superior to large classes which may not provide as much of these educational conditions (Noli, 1980). According to Bloom's taxonomy of cognitive development, as reported by Noli (1980), small classes allow proper conditions for "teaching to mastery" by setting the "parameters" on how much mastery learning can occur (Noli, 1980). Also, for the teacher's role in quality due to class size, smaller classes create a higher level of expectation that a teacher has of students (Noli, 1980). Higher teacher expectations often produce higher student morale and performance, says Noli (1980).

Some other generalizations about the qualitative effects of class size are reported by Beckner (1978). Teachers, says this researcher, use a wider variety of instruction in smaller classes than in larger classes. The students benefit from individual instruction, from the more creative work and the divergent thinking processes, which can be encouraged and monitored in smaller classes (Beckner, 1978). The teachers of small classes are able to teach basic skills and also to teach subject mastery better than are teachers of larger classes (Beckner, 1978). Finally, as do other researchers, Beckner (1978) notices that teachers' attitudes are better in small classes than in large classes.

David Squires (1980) notes that among other "indicators of effectiveness" in schools are a low number of discipline problems and a teacher's "extensive contact with a limited number of students in several aspects of their education."

A report by the American Federation of Teachers (1973) states that small classes were necessary for individualization of instruction, individualization, in turn, being necessary for better meeting learning needs, especially in elementary school.

Using a tool called "Indicators of Quality" as the criterion of classroom quality, Martin Olson (1971) found that the lecture format of instruction produced the poorest classroom quality in both elementary and secondary schools. Small group work, as an instructional method, produced the highest scores for quality. Likewise, quality scores decreased as class size in both elementary and secondary schools increased (Olson, 1971). The scores were based on the reports, via "Indicators of Quality," of trained observers using the quality evaluation tool (Olson, 1971).

The scores of the tool reflect a classroom's quality on four criteria: individualization, interpersonal regard, group activity, and creativity (Olson, 1971). Olson points out, however, that quality is effected directly by educational activity, implying that class size indirectly allows for different activities, the suitability of which varies with academic subject student demographics, and other contextual values. He also adds that the use of paraprofessionals enhances classroom quality in elementary classes, but that in secondary classes where more than one adult is present, quality scores are consistently more than 3.0 points lower (Olson, 1971).

In a meta-analysis of classroom processes and quality, similar to that of achievement due to class size, Gene Glass found significant evidence to support the notions that smaller classes provided for: greater teacher knowledge of pupils; better student/teacher interaction; greater variety of instructional activities; more small group work; greater teacher directiveness; more positive teacher control; more creative instruction; more frequent conferencing with parents; more material covered; more positive evaluation and feedback; better use of space; and better general quality of instruction (Glass and Smith, 1979).

The results of Filby's study connected smaller classes with: easier classroom management; fewer discipline problems and less teacher anxiety; less time wasted; greater teacher "withitness"; greater ease at monitoring classroom activity; less summative and more formative evaluation; a greater amount of hands-on learning activities in the form of class trips, science projects; more time for poetry, work folders, story-writing, games, labs, nature walks, and so forth; and, in all, greater teacher accuracy in diagnosis and monitoring (Filby, 1980).

Though the teacher plays an important role in establishing the quality of a class, it is the students who receive the benefits of that quality and who, by their behavior, contribute the most to setting the level of that quality. How does class size effect educational quality through the students?

Just as smaller classes allow more intimate student-teacher interaction, so they similarly affect the interelationships among students, providing, theoretically and according to the beliefs of some researchers, for better interstudent cooperation and peer teaching (Noli, 1980). I have carefully qualified the previous statement in light of the afore mentioned ill effects (stress, peer pressure, etc.) of small class societies. And yet, although Ward (1975) argues that there is no significant results to support the belief that smaller classes produce better student attitudes, other studies have directly connected class size with positive attitudes for both teachers and students (Beckner, 1978; Squires, 1980; Glass and Smith, 1979; Filby, 1980).

Whether or not attitude changes arise from class size changes and the resulting changing interpersonal conditions, other directly academic results occur from modifying student interaction. Students learn group behavior, leadership and participation skills in small classes better than they do in larger classes (Beckner, 1978). Interpersonal regard is better in small classes than in large classes (Beckner, 1978; Olson, 1971). Smaller classes usually offer better opportunity for attaining goals (Beckner, 1978). And when students believe they can succeed, that they can get ahead without being unfairly held back, their performance and progress is better (Squires, 1980).

Olson summarizes that "any way one tries to slice it, small classes produce significantly higher scores [on the "Indicators of Quality" criterion] than large ones" (Olson, 1971). A student's level of interpersonal regard, faculties of creativity, participation in group activity, and individual contact with teachers and other students are all better in smaller classes than in larger ones (Olson, 1971).

Filby reiterates these findings (1980), warning in addition that quality judgments are often subjective. She calls for greater care in considering the factors of positive classroom quality. Some of the effects which class size have on students' quality experience, according to Filby (1980), are: greater attention to academic tasks; greater active involvment in class lessons; greater participation, self-control, respect, and responsibility with other students.

Glass found that, according to previous studies, smaller classes have a positive effect on student attitude, individualization, and student participation (Smith and Glass, 1979). These effects produce better study habits, student directedness, student engagement, interest and enthusiasm, better self-concept, and better attitude toward teachers, school and class (Smith and Glass, 1979).

Another element which contributes to the quality of classroom process, and which is also related to the effects of class size, is classroom density, or crowding. Don Bushnell (1978) has found that students who are highly anxious perform significantly better on exams in small sized classes. He pretested students for their general dispositions of anxiety, determining them to be either highly, marginally, or minimally anxious (Bushnell, 1978). Then, he analyzed the exam scores of these students in large, heavily pop-

ulated, lecture-hall type environment, and small, not-heavily-populated, lab-type environment. The scores of low anxiety students in the large, dense class were approximately twenty points higher on the average than those of high anxiety students, while in the lab environment, the mean difference between the scores of high anxiety and low anxiety students was not statistically significant (Bushnell, 1978). Marginally anxious students scored over twenty points worse on their exams when sitting directly adjacent to a highly anxious student than they did when they were not sitting directly adjacent to the high anxiety student (Bushnell, 1978). Even students with low levels of anxiety performed slightly better in smaller, less dense classes than they did in the larger, densely populated classes. In short, all of the pupils in Bushnell's study reacted negatively to the distracting arousal of crowding (Bushnell, 1978).

David Weldon and colleagues (1981) expound on the phenomenon of crowding as a componet of the class size/class quality issue. Their results differ from Bushnell's in that they find the perception of crowding, even in small lab-like classrooms, to cause as much stress, and therefore just as unsuccessful of an academic experience, as the large lecture hall. Weldon offers a counter-argument to those people favoring greater interaction as a small class benefit: "if increased interaction implies increased competition for resources, then perception of crowding increases" (Weldon, 1981). But he adds that "if increased interaction implies increased cooperation, then perception of crowding decreases" (Weldon, and others, 1981). Weldon also offers an interesting commentary on the way people of different genders react to the conditions of crowding, noise,

and interpersonal contact. Males, he observes, attribute high noise level to high amounts of interpersonal contact and therefore to feeling crowded. Females seem to make no such assumption of causality with respect to noise level, and would not necessarily feel crowded just because a room was noisy (Weldon, 1981). Such findings emphasize the student's gender as a variable of class size effect, as an earlier mentioned study by Lindsey points out.

In spite of all the ostensible advantages for instruction in small classes, Weldon (1981) notes that even tutorials may suffer from the effects of crowding. Group size is less important than group dynamics; and if there are fewer students, but those students are constantly violating each other's space and jockeying for the teacher's special attention, then the class will suffer as much from crowding as one of three times the size (Weldon, 1981).

Also, physically speaking, density, the "moderator of arousal," is a combination of population and available space. For this reason, Weldon rejects the notion that classes are too large. According to his research, "class size up to 35 students for a standard 24 ft. x 32 ft. classroom should facilitate achievement" (Weldon, 1981). He adds quickly that "this conclusion must be tempered by other considerations" (Weldon, 1981). One can assume that if a teacher considers the shape of a room, the proximity of certain personality types to certain other personality types, the noise level and room acoustics, and so forth, the he or she will be more in control of the quality of education available for any particular population size.

Some Particularly Comprehensive Studies

There have been several studies performed since 1970 which speak to both achievement and quality in different class sizes. The most remarkable of these studies, remarkable because of its combination of thoroughness, control, and startling content, is a study performed in Ontario by Stan Shapson and his colleagues (1978). In this study, the researchers created balanced and heterogeneous classes of sizes 16, 23, 30, and 37; then they performed pretests for achievement on the students. They they pretest on the participating teachers for their expectations of classroom quality and student achievement, and of the ways they would alter their methods for the smaller classes. The teachers were then observed during the year to test their expectations and beliefs against their actual behavior. The researchers also tested parents' expectations regarding the effects that the smaller classes would have on their children (Shapson, 1978).

The testing of students included, as well as standardized tests for achievement, the analysis of student's art and composition samples, and questionaires examining students' attitudes and self-concepts. The study was run over a period two years, with a shifting of the class size and teacher population after the first year to make sure no teachers or students participated in same-sized classes for two consecutive years. The same students and teachers were used both years, but they were moved to different classes. The students were in grades four the first year of the study, and, obviously, grade five the second (Shapson, 1978). The methods of analysis

were Olson's "Indicators of Quality," The Toronto Classroom Observation Schedule, The Canadian Test of Basic Skills, The New York Self-Concept Inventory, and questionaires prepared for determining teachers' and parents' expectations (Shapson, 1978).

The first phase of the results--teacher and parent expectation--proved that these individuals were confident that smaller class size would have a positive effect on the students. Teachers expected greater individualization, involvement, special attention and a more relaxed classroom tone in smaller classes. They expected larger classes to be more rigidly controlled, less individualized, and more restricted. And they believed that their teaching strategies, their use of floor space and audio-visual aids, and their effectiveness in student evaluation would all be improved in smaller classes (Shapson, 1978). There was the assumption, also, that smaller classes would produce better student achievement (Shapson, 1978). The expectations of parents were similar to those of teachers (Shapson, 1978).

As the years unfolded, however, there was only a small effect of class size on overall achievement, significant benefits occurring in the subject of mathematics concepts in classes of 16 students (Shapson, 1978). Performance in math concept learning was significantly less in classes of size 30 than classes of 16. Achievement was also less in classes of 23 and 37 than math concept achievement in classes of 16, but the differences werenot significant (Shapson, 1978). There was no other significant effect of class size on achievement, either in art or composition, vocabulary, reading, or math problem solving (Shapson, 1978).

There was no significant effect, according to the "Indicators of Quality," of class size on amounts of individualization, interpersonal regard, creative

expression, or group activity (Shapson, 1978). No pupil participation variables were affected by class size. Pupil satisfaction, self-concept and attitude toward school were unaffected by class size (Shapson, 1978). Although the number of pupils addressed individually was higher in classes of 16 than those of 23, 30, or 37, none of the other variables for teacher pupil interaction, such as lecturing vs. other teaching methods, or amount of teacher police behavior, was affected by smaller classes. In fact, if any result occurred in terms of instructional method, it was that lecturing was used less frequently in classes of 30 than in any other class size. Reading occurred more frequently in classes of 16 than in classes of 30, but there was no other relationship of class size to subject matter noticed by the researchers (Shapson, 1978).

There was no significant effect of class size on the use of audio-visual or mechanical conrete aids. And written aids were used more often in classes of 23 and 30 than in classes of 16 (Shapson, 1978).

There was also no significant effect of class size on classroom atmosphere (Shapson, 1978).

The most interesting point of Shapson's study is his finding that teachers, even after the two years of the experiment, still indicated that they believed they had significantly altered their methods of instruction, their uses of special teaching aids, and their amount of teacher-pupil interaction and individualization, even though observation proved that no such alterations had taken place (Shapson, 1978). Teachers' expectations, attitudes and perceptions seemed, among all the other class size variables, the most and almost the only strongly affected factor in the academic environment.

Granted, a good teacher attitude is not harmful, but other studies have shown that class size, though it may affect teachers' attitudes, does not affect actual teacher behavior (Oakley, 1970). And a teacher's preference for small classes will not have any direct, positive effect on the students in those smaller classes (Woodson, 1968).

Edgar Wright (1977) reports this same Ontario class size study, mentioning as a rationale for the study's variety of approaches, that one should not only be concerned with achievement test scores, but with conditions under which pupils learn. He emphasizes that class size questions are really questions of teaching method: of purposes, goals, and executions (Wright, 1977).

One flaw that I find in the study reported by Shapson (1978) and Wright (1977), is that by changing classes after the first year, the researchers lose theimportant factor of longitudinal adjustment, pointed out by other studies. Another possible flaw in the Ontario research is the fact that their average class sizes vary in reality so that what is called 16 may range from 12-20; likewise "23" may range from 20-27, and so on. Comparisons between classes that show no significant differences may, in fact, be comparisons between two classes of the same size.

Other studies have confirmed the confusing role of class size on overall educational experience. A study performed on Edward Clark High School students in Las Vegas (1968) found that there was no significant effect due to class size on academic attainment or satisfaction with learning environment for classes in Business Law, or Introduction to Business.

There was also no significant difference in student satisfaction due to class size in U.S. Government classes, but in these same classes, there was an apparent positive effect on academic attainment in smaller classes (Clark High School, 1968).

Wilbert McKeachie (1971) found that although smaller classes seemed to promote retention, critical thinking, and positive academic attitudes, larger classes allowed more room for a teacher to exercise his or her imagination, the greater number of students allowing the teacher to use more combinations of instructional approaches. McKeachie (1971) also found that combinations of discussion with lecture produced the most positive academic and attitudinal results in students, depending, he adds, on the method of testing, on how the student is, and expects to be, evaluated.

Cheatham (1976) finds that smaller classes (20) are more desirable for performance-oriented courses (foreign languages, English composition, driver's education, speech communication, for example) and that students in large classes (80) do well in classes of lecture-exam format. He finds that the undesirable class size for success in either performance or exam scoring is that of approximately 40, compared with the other two sizes (Cheatham, 1976).

Based on the beneficial effects from combining size conditions, as reported by McKeachie (1971) and Cheatham (1976), Larry Weber has determined that a large class which practices small group work in special sessions would utilize the benefits of both sizes, satisfying, as well, the concerns with costs of creating smaller classes in public schools (Weber, 1977).

Somewhat contrarily, B. H. O'Donnell recommends reducing class size early on, in the elementary years, to prevent some of the academic problems that occur in secondary schools. It is in the secondary schools where the

student populations are larger and where the need for smaller remedial classes would most severely disturb the already fragile demographics of teacher and space availability (O'Donnell, 1977). Using smaller classes in elementary school is, economically, less harmful, and it serves as pro-active preventive medicine for academic achievement rather than as reactive measures which are oftentimes too late in coming to those who need help the most (O'Donnell, 1977).

Conclusion

Class size effects on achievement and classroom environment are not as simple nor as uniform as one might think. But with a thorough understanding of particular class size factors and reactions, coupled with directive and diverse teacher education, teachers can confront the different classroom situations which present themselves from year to year or from school to school with the possibility of optimum academic success. Given these preparations in intelligence, versatility, and background, and given patience and dedication, class size should not have any effect on achievement or quality in the classroom.

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